

# BSS138L, BVSS138L

## Power MOSFET 200 mA, 50 V

### N-Channel SOT-23

Typical applications are DC-DC converters, power management in portable and battery-powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

#### Features

- Low Threshold Voltage ( $V_{GS(th)}$ : 0.5 V–1.5 V) Makes it Ideal for Low Voltage Applications
- Miniature SOT-23 Surface Mount Package Saves Board Space
- BVSS Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

#### MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Rating                                                                                                           | Symbol            | Value       | Unit               |
|------------------------------------------------------------------------------------------------------------------|-------------------|-------------|--------------------|
| Drain-to-Source Voltage                                                                                          | $V_{DS}$          | 50          | Vdc                |
| Gate-to-Source Voltage – Continuous                                                                              | $V_{GS}$          | $\pm 20$    | Vdc                |
| Drain Current<br>– Continuous @ $T_A = 25^\circ\text{C}$<br>– Pulsed Drain Current ( $t_p \leq 10 \mu\text{s}$ ) | $I_D$<br>$I_{DM}$ | 200<br>800  | mA                 |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$                                                               | $P_D$             | 225         | mW                 |
| Operating and Storage Temperature Range                                                                          | $T_J, T_{stg}$    | – 55 to 150 | $^\circ\text{C}$   |
| Thermal Resistance,<br>Junction-to-Ambient                                                                       | $R_{\theta JA}$   | 556         | $^\circ\text{C/W}$ |
| Maximum Lead Temperature for<br>Soldering Purposes, for 10 seconds                                               | $T_L$             | 260         | $^\circ\text{C}$   |

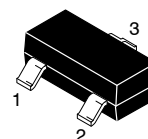
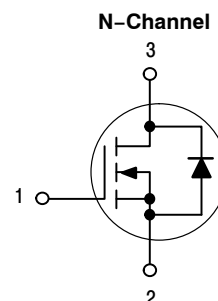
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



ON Semiconductor®

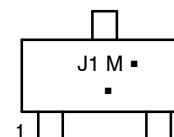
<http://onsemi.com>

200 mA, 50 V  
 $R_{DS(on)} = 3.5 \Omega$



SOT-23  
CASE 318  
STYLE 21

#### MARKING DIAGRAM



J1 = Device Code  
M = Date Code\*  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

\*Date Code orientation and/or overbar may vary depending upon manufacturing location.

#### ORDERING INFORMATION

| Device      | Package             | Shipping†            |
|-------------|---------------------|----------------------|
| BSS138LT1G  | SOT-23<br>(Pb-Free) | 3000 / Tape & Reel   |
| BVSS138LT1G | SOT-23<br>(Pb-Free) | 3000 / Tape & Reel   |
| BSS138LT3G  | SOT-23<br>(Pb-Free) | 10,000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                                                                                                                                                                                                                                                               |               |             |             |                   |                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------|-------------|-------------------|-----------------|
| Drain-to-Source Breakdown Voltage<br>( $V_{GS} = 0\text{ Vdc}$ , $I_D = 250\text{ }\mu\text{Adc}$ )                                                                                                                                                                           | $V_{(BR)DSS}$ | 50          | –           | –                 | Vdc             |
| Zero Gate Voltage Drain Current<br>( $V_{DS} = 25\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $25^\circ\text{C}$ )<br>( $V_{DS} = 50\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $25^\circ\text{C}$ )<br>( $V_{DS} = 50\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $150^\circ\text{C}$ ) | $I_{DSS}$     | –<br>–<br>– | –<br>–<br>– | 0.1<br>0.5<br>5.0 | $\mu\text{Adc}$ |
| Gate-Source Leakage Current ( $V_{GS} = \pm 20\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )                                                                                                                                                                                        | $I_{GSS}$     | –           | –           | $\pm 0.1$         | $\mu\text{Adc}$ |

### ON CHARACTERISTICS (Note 1)

|                                                                                                                                                                                                                |              |        |          |           |          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------|----------|-----------|----------|
| Gate-Source Threshold Voltage<br>( $V_{DS} = V_{GS}$ , $I_D = 1.0\text{ mAdc}$ )                                                                                                                               | $V_{GS(th)}$ | 0.5    | –        | 1.5       | Vdc      |
| Static Drain-to-Source On-Resistance<br>( $V_{GS} = 2.75\text{ Vdc}$ , $I_D < 200\text{ mAdc}$ , $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ )<br>( $V_{GS} = 5.0\text{ Vdc}$ , $I_D = 200\text{ mAdc}$ ) | $r_{DS(on)}$ | –<br>– | 5.6<br>– | 10<br>3.5 | $\Omega$ |
| Forward Transconductance<br>( $V_{DS} = 25\text{ Vdc}$ , $I_D = 200\text{ mAdc}$ , $f = 1.0\text{ kHz}$ )                                                                                                      | $g_{fs}$     | 100    | –        | –         | mmhos    |

### DYNAMIC CHARACTERISTICS

|                      |                                                                  |           |   |     |     |    |
|----------------------|------------------------------------------------------------------|-----------|---|-----|-----|----|
| Input Capacitance    | ( $V_{DS} = 25\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\text{ MHz}$ ) | $C_{iss}$ | – | 40  | 50  | pF |
| Output Capacitance   | ( $V_{DS} = 25\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\text{ MHz}$ ) | $C_{oss}$ | – | 12  | 25  |    |
| Transfer Capacitance | ( $V_{DG} = 25\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\text{ MHz}$ ) | $C_{rss}$ | – | 3.5 | 5.0 |    |

### SWITCHING CHARACTERISTICS (Note 2)

|                     |                                                       |              |   |   |    |    |
|---------------------|-------------------------------------------------------|--------------|---|---|----|----|
| Turn-On Delay Time  | ( $V_{DD} = 30\text{ Vdc}$ , $I_D = 0.2\text{ Adc}$ ) | $t_{d(on)}$  | – | – | 20 | ns |
| Turn-Off Delay Time |                                                       | $t_{d(off)}$ | – | – | 20 |    |

1. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
2. Switching characteristics are independent of operating junction temperature.

TYPICAL ELECTRICAL CHARACTERISTICS

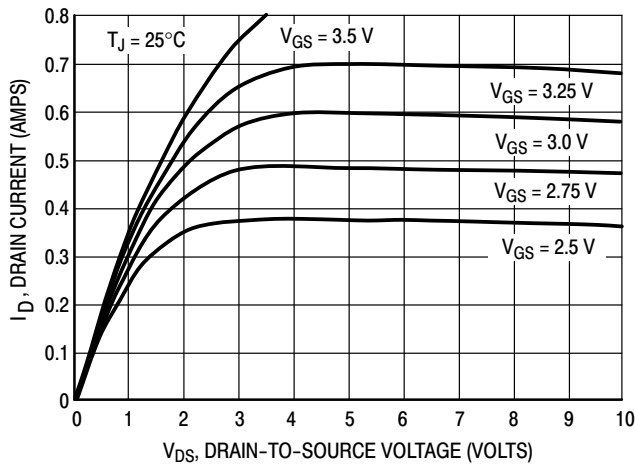


Figure 1. On-Region Characteristics

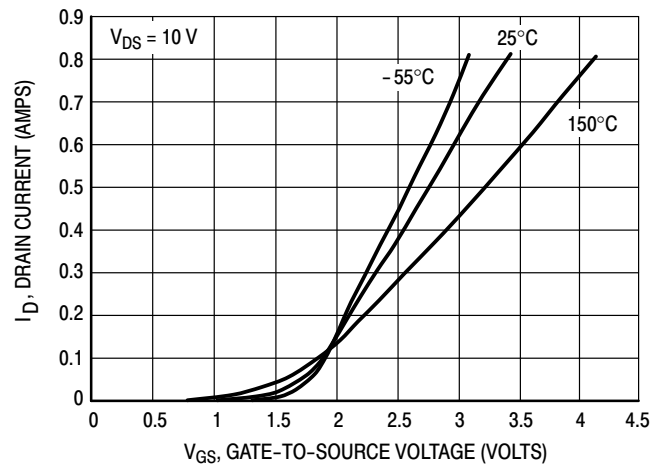


Figure 2. Transfer Characteristics

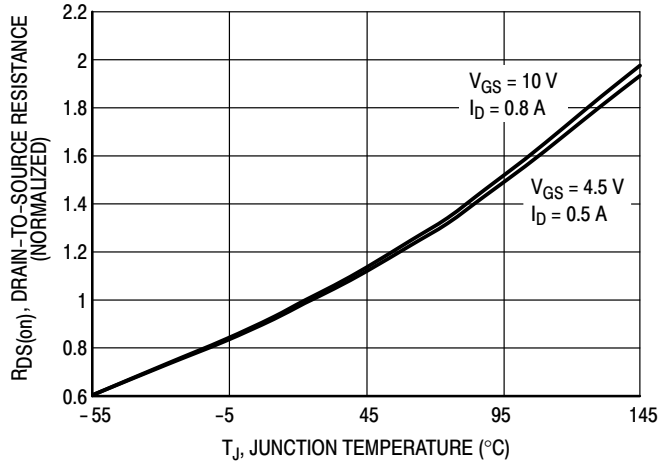


Figure 3. On-Resistance Variation with Temperature

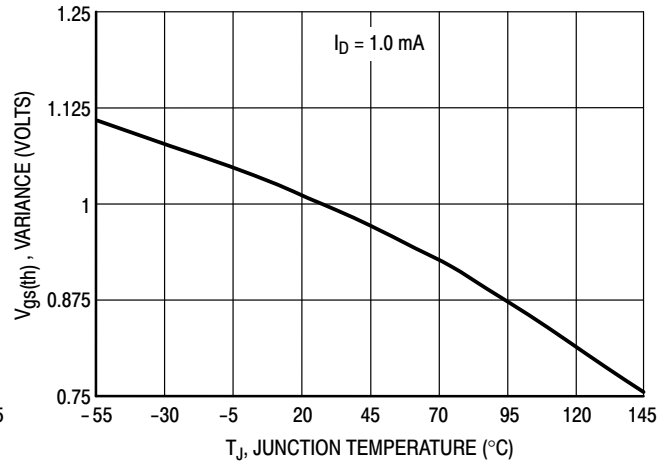


Figure 4. Threshold Voltage Variation with Temperature

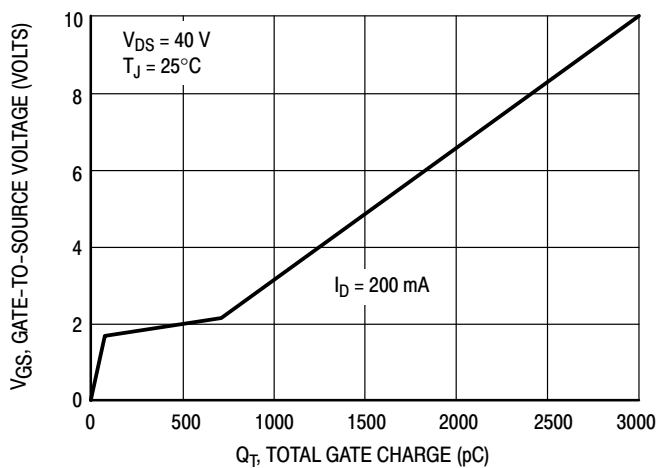


Figure 5. Gate Charge

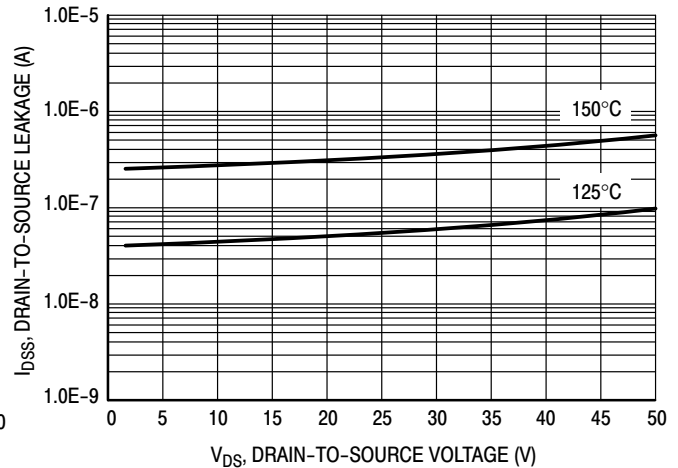


Figure 6. IDSS

TYPICAL ELECTRICAL CHARACTERISTICS

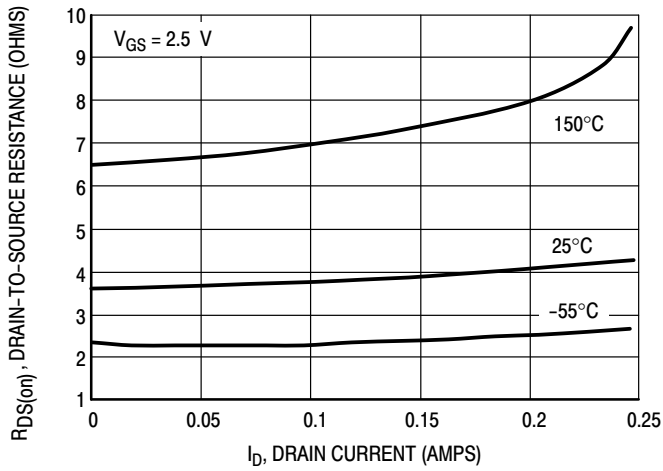


Figure 7. On-Resistance versus Drain Current

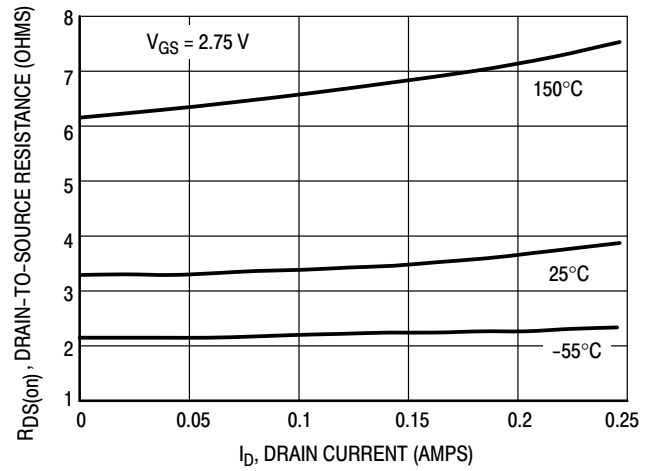


Figure 8. On-Resistance versus Drain Current

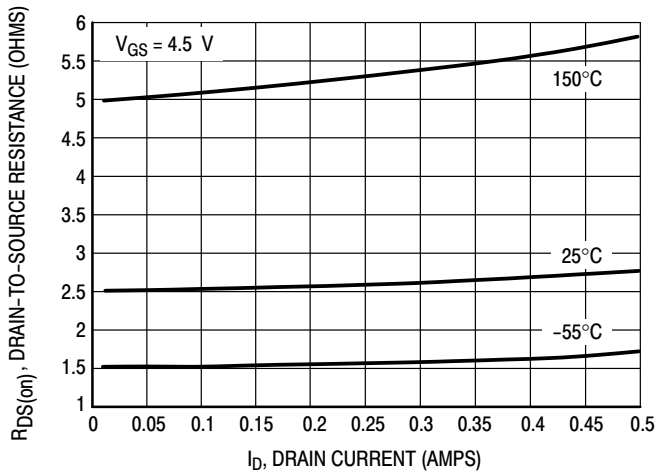


Figure 9. On-Resistance versus Drain Current

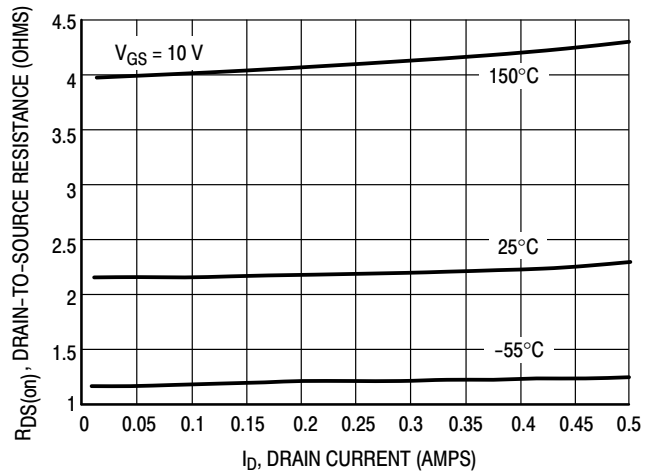


Figure 10. On-Resistance versus Drain Current

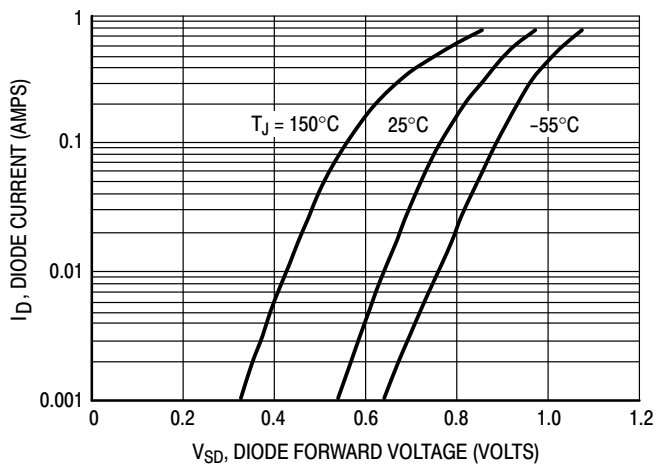


Figure 11. Body Diode Forward Voltage

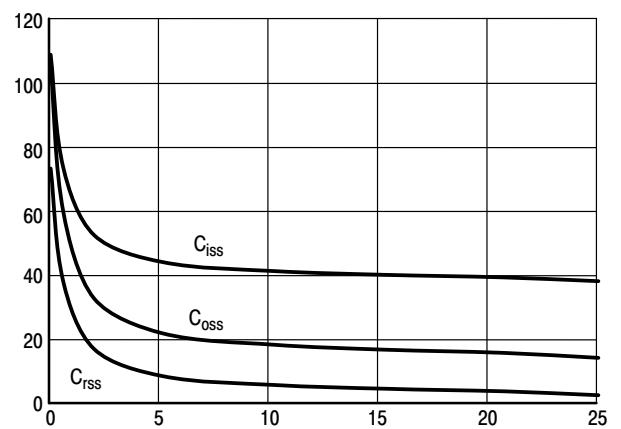
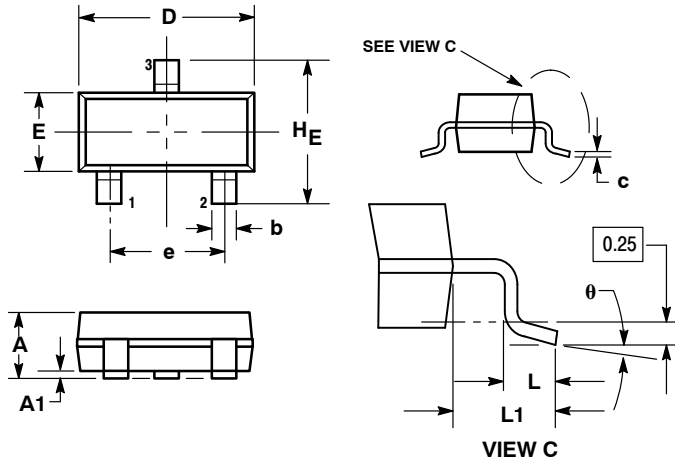


Figure 12. Capacitance

# BSS138L, BVSS138L

## PACKAGE DIMENSIONS

### SOT-23 (TO-236) CASE 318-08 ISSUE AP



#### NOTES:

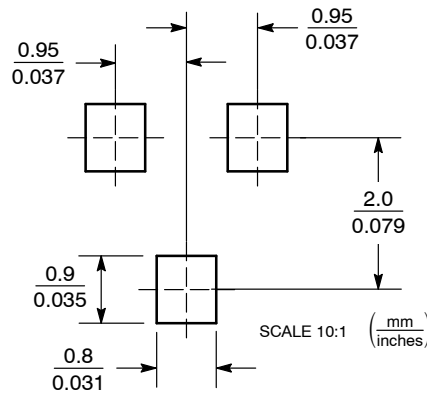
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS |      |      | INCHES |       |       |
|-----|-------------|------|------|--------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN    | NOM   | MAX   |
| A   | 0.89        | 1.00 | 1.11 | 0.035  | 0.040 | 0.044 |
| A1  | 0.01        | 0.06 | 0.10 | 0.001  | 0.002 | 0.004 |
| b   | 0.37        | 0.44 | 0.50 | 0.015  | 0.018 | 0.020 |
| c   | 0.09        | 0.13 | 0.18 | 0.003  | 0.005 | 0.007 |
| D   | 2.80        | 2.90 | 3.04 | 0.110  | 0.114 | 0.120 |
| E   | 1.20        | 1.30 | 1.40 | 0.047  | 0.051 | 0.055 |
| e   | 1.78        | 1.90 | 2.04 | 0.070  | 0.075 | 0.081 |
| L   | 0.10        | 0.20 | 0.30 | 0.004  | 0.008 | 0.012 |
| L1  | 0.35        | 0.54 | 0.69 | 0.014  | 0.021 | 0.029 |
| H_E | 2.10        | 2.40 | 2.64 | 0.083  | 0.094 | 0.104 |
| θ   | 0°          | ---  | 10°  | 0°     | ---   | 10°   |

#### STYLE 21:

- PIN 1. GATE
- SOURCE
- DRAIN

### SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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